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The Philippine Journal of Otorhinolaryngology-Head and Neck Surgery is committed to the publication of scientific work on the specialty. It seeks to disseminate timely and relevant information to improve practice and to inform health policy. It provides a forum for the continuous exchange of views among health professionals concerned with the provision of quality otolaryngologic care.

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Editorial

ENT Technology: the Good, the Bad and the Overrated

No sooner have we started to understand whom cochlear implants can be good for are we now tantalized by the possibility of restoring hearing to the profoundly deaf with brainstem implants. Adapted to viewing and tweaking the nose through a keyhole, we now are faced with doing the same thing while peering at the middle ear. Newfangled health technologies attract patients and income. Hospitals and doctors are therefore naturally attracted to them. Once they are entrenched, useless but expensive ones are hard to abandon.

"Old" technologies can suffer as much misuse. Thus, we are concerned with the infrequent use of topical antimicrobials for chronic draining ears and the unbridled enthusiasm for tonsillectomizing just about any body with a recalcitrant sore throat.

Health technology assessment (HTA) is the systematic evaluation of the intended and unintended effects of drugs, devices, procedures and organizational systems used to deliver health care. Thus HTA evaluates efficacy, effectiveness, safety, cost, and cost-effectiveness, as well as legal, political, social and ethical issues.

The effectiveness and safety of many health technologies are used without being completely evaluated (think FESS). Many are oversupplied (think MRIs). Those that have evaluated are often used beyond the indications evaluated (think hearing aids). Those that have been evaluated and used for indications evaluated are often over-utilized (think antibiotics). Finally, many are used in place of more cost-effective options (think routine CT scans instead of Waters view).

Assessing health technologies requires retrieving available published evidence or conducting studies on the technology in question, interpreting the results of the literature search or the primary research, synthesizing and consolidating the evidence with clinical experience and societal values, and formulating recommendations.

For example, assessing the value of lasers for benign vocal cord lesions would involve reviewing the literature for randomized controlled trials that compare lasers with conventional surgery. After finding out that only one RCT done in 1997 by Keilman et al, in which the postoperative results of laser and microsurgical treatment were found to be comparable, one then concluded that there are insufficient grounds for widespread use of this device. One then considers what foreign and local experience with lasers has been and whether expert opinion, patients' preferences and social values would modify this conclusion.

Curbing unnecessary expenditures on questionable health technologies becomes important as health care expenditures more from the hands of private individuals to government and third-party payors. In Sweden, a cost-effectiveness study was used to regulate the introduction of the CT scan in 1973. Despite Sweden being the world leader in medical device development, HTA is responsible for the continued regulation and efficient use of neuroradiological equipment in this country.

In the Philippines, the Philippine Health Insurance Corporation has set up a HTA unit to assist in decisions concerning reimbursement and insurance coverage of treatment and diagnostic tests. The DOH will most likely follow suit.

As ENT specialists we should welcome this move as a salutary means to improve the availability of truly effective technologies, weed out the useless and harmful ones, and educate both the health and the general community on the value of skepticism and restraint. Some may view HTAs as another means to usurp physicians' autonomy and the patients' right to choose. What we would all agree, however, is that since health care resources are not only finite but also incredibly shrinking, hard choices have to be made by those who pay for services. Unless we are armed with the knowledge to engage them, such choices may be made without us.

Jose Acuin, MD, MSc

Original study

A Comparison of the Mucus Transport Time between Filipinos Living in Urban and Rural Areas.

Ramos III, Ramon P, MD*; Lagman, Victor John C, MD*; Campomanes, Jr, Benjamin S, MD**

Objectives: To determine the differences of mucus transport time between Filipino populations living in urban and rural communities, and to establish baseline data on the mucus transport time among Filipinos.
Design: Observational study
Setting: Urban (Metro Manila) and rural (Sta. Elena, Camarines Norte) communities
Subjects: Fifty (50) adult Filipinos randomly chosen from residents of Metro Manila (n=25) and residents of Sta. Elena, Camarines Norte (n=25).
Results: Majority of the urban subjects (60%) had a mucus transport time (MTT) between 10 min. 01 sec. to 15 min. 0 sec., while that of the rural group (70%) ranged from 5 min. 01 sec. to 10 min. 0 sec. An unpaired t-test ($p<0.05$) showed a much longer MTT in the urban population (11.3+3.3 mins.) when compared to the of the rural population (7.6+2.7 mins.).
Conclusion: Exposure to urban environment is associated with prolongation of the mucus transport time.

INTRODUCTION

No other century perhaps has brought more dramatic changes than the present. Developments in transportation and communication have wrought unforeseen consequences, both in health and in the environment. Air pollution, a major by product of these developments, has reached alarming levels and has been the focus of global concern in recent years. Its detrimental effects have given rise not only to the infamous "greenhouse effect" but have also been felt in clinics worldwide. Medical practitioners in countries as diverse as Japan and Germany have reported a significant increase in the incidence of upper respiratory tract infections and allergy-related complaints. Much of these illnesses implicate an impaired mucociliary clearance on which the upper respiratory tract integrity is maintained.

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**Consultant, STUH

Nasal mucociliary function is the primary physiologic process by which airborne particles are entrapped in a blanket of mucus and propelled by ciliary action to cleanse and filter inspired air of these pollutants.

Appropriate mucociliary clearance, however, is only possible in the presence of normal ciliary movement and an adequate mucus blanket, which may be impaired in smokers, asthmatics, sinusitis patients, or in populations exposed to a high density of particles suspended in air. Mucociliary function may be determined by various parameters such as: mucus transport time (MTT), mucus transport rate (MTR), electrophoretic studies, or via electron microscope imaging of the mucus and cilia. For this particular study, the MTT was chosen for its simplicity, brevity and ease of execution, and for being minimally invasive and inexpensive.

To determine whether mucociliary clearance (the key mechanism by which the upper air way is protected from atmospheric insult) would be significantly altered by air pollution, this study began by

initially establishing baseline data on the mucus transport time among Filipinos and compared the MTT between populations living in urban and rural centers.

SUBJECTS AND METHODS

Fifty (50) adult Filipinos, both male and female, were randomly chosen, 25 were residents of Metro Manila for the last two years or more, while the other half were residents of Sta. Elena, Camarines Norte for the same duration.

Excluded were smokers, asthmatics, as well as those with previous or current sino-nasal or pulmonary disease, previous sino-nasal surgeries. Those who have had upper respiratory tract infection, topical nasal medications or systemic abticholinergics within the last three weeks were also excluded.

In the selection of localities covered by the study, the air pollution index was initially favored. However, sources at the Department of Environment and Natural resources (DENR) could not provide the authors with the necessary data. The study group opted instead for the next best determinant of air pollution, namely the number of registered vehicles per locality. This was reflective of the index of pollution density, since automobile exhaust contributes immensely to air pollution. Data from the Land Transportation Office (LTO) showed that Metro Manila had the highest number of registered vehicles in the Philippines, while Sta. Elena, Camarines Norte was among the three locales which had the least. (The others being in Palawan and Batanes and which were thus inaccessible for the study).

Subjects were instructed to sit upright after cleaning the nasal passages. The nasal cavity was checked for any gross abnormalities or masses. Participants then underwent a saccharin test, wherein a standardized minimal amount (0.04 g, as measured on the Mettler balance) of the sweetener was introduced 1-2 cm behind the leading edge on the medial aspect of the inferior turbinate. They were instructed to swallow every 20 seconds, and the first moment of perception of sweetness was the endpoint. The time which was recorded in seconds (s) – between the application of the test substance and the first definitive sense of the saccharin was defined as the mucus transport time (MTT).

All subjects signed an informed consent prior to testing. Subjects were instructed to refrain from coughing, sneezing, or sniffing during testing; however, should they be unable to do so, the test was repeated the following day.

RESULTS

Twelve males and 13 females, with ages ranging from 20 to 40 years, comprised the urban group. MTTs ranged from 320 sec (5'20") to 1200 sec (20'00"). The mean MTT was 678.40 sec (11'18").

The rural group, made up of 14 males and 11 females and with ages ranging from 20 to 37 years old, registered MTTs ranging from 300 sec (5'00") to 1000 sec (16'40") with a mean of 457.08 sec (7'37"). Unpaired t-test showed that this difference in mean MTTs was statistically different ($p<0.05$).

None of the urban subjects registered an MTT of 300 s (5'00") or less. More than half (15 subjects, 60%) had an MTT between 601 to 900 s (10'01" to 15'00"), 8 (32%) had an MTT ranging from 301 to 600 s (5'01" to 10'00"), and 2 subjects (8%) claimed to have perceived sweetness 900 s and beyond ($\geq$ 15'00") after application of saccharin.

Well over three-quarters (19 subjects, 76%) of the tested residents of Sta. Elena had a shorter MTT that ranged from 301 to 600 s (5'01" to 10'00"), while 3 subjects (12%) showed a transport time of 601 to 900 s (10'01" to 15'00"). Two rural residents (8%) perceived the test substance within 300 s (5'00") or less. Only 1 (4%) had an MTT of more than 900 s (15'00").

Date were subjected to statistical analysis using unpaired *t* test, with significance set at $p<0.05$. Results showed that the MTT of the urban population was significantly longer (678 ± 198 s or 11.3 ± 3.3 minutes) compared with that of the rural population (456 ± 162 s or 7.6 ± 2.7 minutes).

DISCUSSION

Mucociliary clearance has largely been responsible for the integrity of the entire respiratory tract. It serves as a protective mechanism against foreign bodies, dust particles, noxious substances, and pathogenic organism.

Of late, the nasal passages have encountered a new adversary: air pollution. This byproduct of economic progress and urbanization has had a dramatic rise in pollution levels, if not a critical state. Allergology and rhinology clinics in urban centers have reported an increased incidence of allergy-related rhinitis.

A number of foreign studies have dealt with the effect of air pollution on mucociliary clearance. Initial reports from Japan, Germany, and England have implicated diesel emission particles (DEP) as the primary culprit in the increased incidence of allergic rhinitis in their respective countries. However, no local data have so far been available to support this, much less investigate the effects of air pollution on mucus transport. Furthermore, no Philippine study has thus far compared mucociliary transport parameters (e.g., time or rate) between two communities of extreme levels (highest and lowest) of air pollution index.

In determining the effects of air particles on the mucus blanket and respiratory cilia, an understanding of its physiology is necessary. Each nasal columnar cell contains between 50-200 cilia, which are tough structures that must be bathed in fluid to function. They have an average length of 6 *vm* and an average diameter of 0.2 *vm*. Upon cross-section, each cilium contains two central microtubules and nine peripheral doublets near the cell. This is the classic "nine-plus-two" arrangement, without which cilia can not properly function. The main function of the ciliated cells in the nasal cavity is to carry mucus back towards the pharynx by continuous wave-like movement. Cilia beat between 10 and 20 times per second (about 1000 beats per minutes) at body temperature, yielding a flow rate of 6 - 7 mm/min.

The other key factor is the mucus blanket, which consists of two components: a thin ***sol*** layer, often referred to as the periciliary fluid, and a superficial thick ***gel*** layer. This gel provides a continuous blanket on top of the periciliary fluid, where the cilia extend during its motion. Together, the cilia and mucus blanket are responsible for trapping as much as 85-90% of particulate matter 5-6 *vm* or greater in size, including viral particles.

It has been established that the presence of mucus is required for surface particle transport. In fact, studies have shown that in spite of continuous ciliary activity long after the death of an organism, active transport persists for a much shorter time because of mucus depletion. Another factor that influences mucus transport rate is the rheologic property (viscosity and elasticity) of the mucus.

The duration by which particulate matter travels along the surface of the nasal cavity via mucociliary transport is referred to as the mucus transport time (MTT). Because of its availability and relative ease of use, the saccharin test has often been cited as the most useful screening tool for ciliary dysmotility and to evaluate mucociliary transport.

The saccharin test is done by putting a small amount of saccharin powder on the inferior turbinate, as described above. The endpoint is the time at which the subject becomes aware of the sweet saccharin taste. Because the test is influenced by the taste threshold of the individual, other methods have been devised to eliminate inter subject variability, making the test even more reliable. A dye may be mixed with the saccharin to serve as a tracer, however, this requires examination of the oropharynx every minute to accurately determine transport into the oropharynx, which some subjects may find unpleasant. Furthermore, this would entail having a fixed anatomical landmark in the pharyngeal wall to maintain consistency of reported data.

Nevertheless, because the saccharin test fulfilled the ideal criteria (clinically relevant, consistent in results, pose no significant threat to the subject, inexpensive, and easy to perform) for

assessing mucociliary activity, the authors decided to forego with the modified saccharin test (saccharin-dye compound) and thus employed the classic method. In fact, it has frequently been used as the "gold standard" for comparison. Perhaps the saccharin-dye compound may be used in later studies when a single investigator design will be employed.

For this particular study, saccharin as a test for MTT was noted at a much longer time in the urban population compared to the rural group. Most of the people tested in Metro Manila (60%) displayed a prolonged MTT while the mean MTT of the Camarines group (7.6±2.7 min.) was similar to the control group in a study by Milgrim, et al. (7.4±3.7 min.) on 30 healthy subjects.

The findings of Waguespack have shown that hardwood, dust, sulfur dioxide, and formaldehyde slowed mucociliary clearance. The effect of smoking has been studied in a number of animal models, and it is clear that ciliary beat frequency is often adversely affected by exposure to tobacco smoke. Stringer, et al. have demonstrated that dry air, ammonia, sulfur dioxide, and nitrous oxide slow mucociliary clearance rates.

Because sulfur dioxide is present in polluted air, it might be prudent to infer that the high density of particles suspended in air may have caused the prolonged MTT in Metro Manila. The control group in Sta. Elena has virtually no registered vehicles and is therefore unexposed to noxious substances, giving rise to a much shorter MTT. The slowing down of mucus transport may partly explain the rising incidence of upper respiratory tract infection in urban centers. Physicians in inner cities abroad have noted an increasing number of patients with allergic complaints, manifested mainly as rhinologic symptoms, probably as a result of the suspended particles present in polluted air.

CONCLUSIONS

Exposure to the urban environment is associated with prolongation of mucus transport time. It is possible that the higher levels of particulate material and noxious emissions in urban air is responsible for this negative effect on nasal mucociliary function.

RECOMMENDATIONS

Should follow-up studies be undertaken in the future, the authors wish to suggest to following:

1. The length of the nasal floor may be taken for two reasons. First, it shall establish anthropometric measurements of the Filipino nasal cavity. Second, the mucociliary transport rate (MTR) may be determined once distance between the inferior turbinate and the oropharynx is known.
2. The actual air pollution index may be used instead of the number of registered vehicles for a given locale.
3. The air content may be analyzed for the individual substances that comprise the particles suspended in air.
4. A dye may be admixed with the saccharin to serve as a tracer, thus obviating intersubject variability.

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Original Study

A Method of Quality of Life Assessment in Filipino Patients with Head and Neck Cancer

Victoria, Roderic P, MD*

Objective: To develop a clinical interview schedule in Filipino that could measure quality of life in patients with head and neck cancer.
Design: Descriptive study
Setting: Tertiary hospital out-patient department
Patients: 68 patients who had undergone head and neck surgery for malignancy seen last year (January-December 1997) at the Out patient department. A Quality of Life Assessment Questionnaire was formulated with the following categories based on their encountered problems/disturbances: pain, eating (chewing/swallowing), activity, employment, speech, shoulder disability, disfigurement, recreation /entertainment/ leisure.
Conclusion: Formulation of a structured clinical interview in patients with head and neck cancer could be advantageous because it is practical, efficient, and cost effective. Information about the patient outcome/quality of life have a wide range of uses. It can assist in making clinical decisions, assessing rehabilitation needs, understanding patient preferences, and also for future therapeutic strategies.

INTRODUCTION

Tumors of the head and neck affect many vital functions that are critical to life and well being--- respiration, deglutition and mobility to name a few. In addition, such tumors create significant cosmetic deformities that disturb or distort the patient's body image, hence, affecting the patients' quality of life.

These physical, physiological, and psychological problems affect the patient's family, associates, and all who come in contact with him during hospitalization. The responses to these problems may ultimately influence the outcome of the therapy. It is important for the head and neck surgeon to be aware of these problems, to anticipate them before they arise, and to use all available resources to deal with them.

Filipino clinicians traditionally have relied on unstructured clinical interviews to obtain patient outcomes data. However, with the increasing concern for a more comprehensive outcomes measurement that includes quality of life, a practical, efficient, and cost-effective questionnaire for obtaining such data has become important.

SUBJECTS AND METHODS

Patients who underwent surgery for head and neck malignancy and who visited the Out-patient Department between January 1997 to December 1997 were included in this study. Detailed medical chart review was conducted. The purpose of this study was explained and informed consent was obtained in accordance with an approved human subjects protocol. Each patient was interviewed and examined by one ENT Resident.

The patients were ask to enumerate the problems/disturbances encountered from their daily living and these were noted and recorded accordingly.

RESULTS

A total of 68 patients who had undergone surgery for head and neck cancer were included in the study.

*Resident, University of the East - Ramon Magsaysay Memorial Medical Center

Table 1. Characteristics of study subjects

Characteristic	No. of subjects
Gender	
Male	43
Female	25
Tumor type	
Squamous cell CA	56
Other	12
Stage	
I	12
II	21
III	23
IV	11
Unknown	1
Location	
Larynx	26
Oral Cavity	17
Pharynx	14
Other	11
Concomitant Therapy	
Radiation	26
Chemotherapy	15
No. of years after treatment	
<1	11
1-3	39
3-6	10
>6	8

63% were males and age ranged from 24-78 years with a mean age of 55 years. The most common tumor type was squamous cell carcinoma (83%) and one third of the patients were in stage III at the time of treatment. The most common tumor location was the larynx 26 (68%).

More than half of the patients received radiation and two thirds of them have been surviving for not more than 3 years after treatment.

Pain was the most commonly encountered problem, followed by difficulties that involve eating, physical activity and seeking employment.

Table 2 Problems encountered by subjects

Problems/ Disturbances	No. of Patients (%) n = 68
Pain	64 (94)
Eating	56 (82)
Activity	54 (79)
Employment	48 (70)
Speech	32 (47)
Shoulder Disability	10 (15)
Disfigurement	8 (12)
Recreation/Enjoyment	8 (12)

Patients were then asked to describe the severity of their problems in each of the domains. The responses were then grouped and sequenced in ascending order of severity. The following scales for each of the domains were obtained:

1.Pananakit
1.1 Walang pananakit
1.2 Bahagyang pananakit na di nangangailangan ng gamot.
1.3 Masakit-nangangailangan ng regular na gamot (hindi narkotiko)
1.4 Matinding pananakit na nangangailangan ng gamot (Narkotiko)
1.5 Matinding pananakit na di kayang lunasan ng anumang gamot.

2. Pagkain
2.1 Pag-nguya
2.1.1Walang problema sa aking pag-nguya
2.1.2 Wala akong problema sa pag-nguya ng mga malalambot na pagkain ngunit may kahirapan sa pag-nguya ng ibang pagkain
2.1.3 Hindi ko kaya ngumuya kahit na malalambot na pagkain.
2.2 Paglunok
2.2.1 Walang problema sa aking paglunok
2.2.2 May kahirapan sa aking paglunok ng ibang pagkain
2.2.3 Mga malalambot at lugaw na pagkain ang kayang lunukin
2.2.4 Hindi ko kayang lumunok dahil "mali ang pinupuntahan" at ako ay nasasamid

3. Gawain
3.1 Aktibo
3.2 May pagkakataong hindi makakilos, pero hindi ito madalas.
3.3 Palagiang nanghihina, bumagal ang kilos pero nakakalabas pa rin.
3.4 Ayaw lumabas dahil walang lakas kumilos.
3.5 Palaging nakaupo o nakahiga at hindi lumalabas ng bahay.

4. Trabaho
4.1Nakakapagtrabaho ako magmula ikawalo ng umaga hanggang alas singko.
4.2"Part time" lang akong nagtratrabaho.
4.3 Walang permanenteng trabaho.

4.4 Walang trabaho.
4.5 Retirado
Bilugan ang isa
4.6 Walang relasyon sa paggamot ng kanser.
4.7 May relasyon sa paggamot ng kanser

5. Pananalita
5.1 Walang pagbabago sa aking pananalita.
5.2 May kahirapan sa pagbigkas ng ibang salita
5.3 Ang aking pamilya at mga kaibigan lamang ang nakakaintindi sa aking pagsasalita
5.4 Hindi naiintindihan ang aking pananalita.

6. Kapansanan sa Balikat
6.1 Wala akong problema sa aking balikat.
6.2 May limitasyon sa paggalaw ng aking balikat ngunit hindi apektado ang aking lakas at gawain
6.3 May mga pagbabago sa aking trabaho na sanhi ng pananakit at panghihina ng aking balikat.
6.4 Hindi ako makapagtrabaho dahil sa problema ng aking balikat.

7. Pagkadispigura/Pagbabago ng anyo o hitsura
7.1 Walang pagbabago ng hitsura
7.2 May kaunting pagbabago ng hitsura.
7.3 Naaapektuhan sa hitsura pero nananatili pa ring aktibo
7.4 Sobrang apektado sa hitsura, nalilimitahan ang gawain dahil sa hitsura.
7.5 Hindi kayang makihalubilo dahil sa hitsura.

DISCUSSION

The physiologic and psychological impact of pain secondary to cancer can lead to lack of sleep, lack of appetite, nausea, and vomiting. Many patients develop feelings of hopelessness and despair, which increase as the patient is subjected to surgery, chemotherapy, radiation therapy or other modalities. They become more and more pre-occupied with pain and gradually lose interest of the environment as pain becomes their central focus.

Head and neck cancer surgery affects the ability of the patient to swallow and chew food, depending on the location and extent of resection, as well as the reconstructive techniques. Cognitive and motivational status can affect the reacquisition of swallowing in dysphagic persons. The management of some of the head and neck tumors, in many cases, will result in altered communication abilities. Shoulder disability may develop from neck dissection in 15% of the patients. Disfigurement from extensive resections due to a large tumors develops in 12% of the patients. Diminished activity, unemployment and being bed-ridden results both from the cancer itself and from its treatment.

A questionnaire in the vernacular-Filipino is advocated in order to facilitate patient comprehension and rapport.

CONCLUSION

Patients who have undergone treatment for head and neck cancer are afflicted by pain, physical deformity, limited physical activity, limited employability and difficulties in eating, speaking and shoulder movement. The presence and severity of these problems can be determined by a simple quality of life questionnaire that has been developed from interviewing these patients. This questionnaire should be validated against existing quality of life scales specific to cancer patients. It should be field tested in a larger group of cancer patients and among physicians who usually treat them.

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Original study

Anatomic Variations of the Intratemporal Course of the Facial Nerve among Filipinos: A Surgical Guide to Mastoidectomy

Deang-Reyes, Jeanette Anastacia, MD, *Aguilar, Natividad A, MDGalope, Roald, MD*, Bonifacio, Armando, MD,*Reyes, Angelo, MD***

Objectives: To determine the variations in the intratemporal course of the facial nerve among Filipinos. the reliability of the conventional landmarks in identifying it and the segment with the most variable course.
Design: Anatomic case series
Materials and methods: 50 temporal bones were harvested and the intratympanic course of the facial nerve in each was followed in detail
Results: The facial nerve coursed 1-2 mm anterior and medial to the dome of the lateral semicircular canal in 66% of the temporal bones. The vertical segment of the facial nerve lay from 1 mm to 6 mm medial to the digastric ridge as it exited through the stylomastoid foramen.
Conclusions: The lateral semicircular canal and digastric ridge remained practical and reliable surgical landmarks in identifying the facial nerve. The lateral semicircular canal was still more consistent of the two. Variations in the course of the facial nerve were most commonly found in the mastoid segment and must be recognized by every otologic surgeon.

INTRODUCTION

One of the structures most "feared" by those performing otologic surgery is the facial nerve[12,18] because injury to it can have devastating effects to both patient and surgeon. Most of the time it is avoided instead of being identified even though experts insist that the facial nerve is unlikely to be injured when it has been identified.[18]

Although most otolaryngologists are familiar with the normal anatomy of the facial nerve, in some instances it may follow an abnormal course in the temporal bone rendering the surgical landmarks useless and the likelihood of iatrogenic facial nerve injury high.[7]

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This study was conducted to describe the anatomical variations of the intratemporal course of thc facial nerve among Filipinos and to help familiarize otologic surgeons with these variations.

MATERIALS AND METHODS

The data from this study were obtained from 50 well-pneumatized temporal bones during a temporal bone course done in our institution. The bones were stripped of soft tissue and periosteum and were mounted to temporal bone holders positioned in such a way as to simulate actual surgery. Operating microscopes were used for optimum lighting and visualization. Dental drills and suction irrigators were used throughout the dissection exposing the landmarks of surgical importance in identifying the

tympanic and mastoid segments of the facial nerve. Measurements were taken in millimeters (mm) using a ruler and a caliper from points such as:

1. distance of the 2nd genu of the facial nerve from the dome of the lateral semicircular canal, anteriorly.
2. medial and lateral depth of the facial nerve in relation to the dome of the lateral semicircular canal.
3. medial and lateral depth of the facial nerve in relation to the digastric ridge.

Measurements were taken by one person three times in a span of 10 days to eliminate intraobserver bias. The values obtained were averaged and recorded. The presence of anatomical variations were carefully noted in the course of the facial nerve dissection.

RESULTS

The facial nerve coursed 1 mm (54%) to 2 mm (46%) anterior to the lateral semicircular canal. Two thirds of the temporal bones showed the facial nerve coursing 1 mm (50%) to 2 mm)18%) medial to the dome of the lateral semicircular canal. The nerve was level with the dome in 26% and 1 mm more lateral to the dome in 6% of the bones.

The vertical segment of the facial nerve as it exists through the stylomastoid foramen lay 1mm to 6mm medial to the digastric ridge. Two millimeters was the most frequent distance obtained in the sample (16/48) and the mean distance was 2.6 mm. In 2 dissected temporal bones the facial nerve was noted to exit lateral to the digastric ridge at a distance of 1mm and 2mm.

The facial nerve lay 1 to 2 mm medial to the dome of the lateral semicircular. On the other hand, its relationship with the digastric ridge was more variable: in 40% of the bones the nerve lay more than 2mm medial to the ridge.

In one bone, the 2nd genu of the facial nerve was located posterior to the lateral semicircular canal. (Figure 5). No other anomalies such as facial nerve bifurcations, trifurcations and hypoplasias were noted.

DISCUSSION

Several cases of facial nerve injury due to temporal bone surgery are found in otolaryngologic literatures. 4 In the cases reviewed by Green et al, it was found out that 57% of iatrogenic facial nerve injuries were consequences of mastoidectomy procedures. Some of the cases reported showed an abnormal course of the facial nerve. Otologic surgeons who intend to eradicate temporal bone disease without damaging the nerve, should not only be familiar with the area around it, but should also keep in mind that the facial nerve may follow an abnormal course.

The intratemporal facial nerve can be divided into 3 segments: labyrinthine, tympanic and mastoid segments. In the surgical treatment of chronic otitis media only the tympanic and mastoid segments are of our concern.

The tympanic or horizontal segment begins just distal to the geniculate ganglion and is 8-11mm long. It slopes inferiorly and laterally as it courses posteriorly and is superior to the tensor tympani muscle. As it progresses posteriorly, it passes above the stapes/oval window and curves anterior to the horizontal semicircular canal thus forming the 2nd genu. The portion of the facial nerve after emerging from the 2nd genu extending to the stylomastoid foramen is known as the vertical or mastoid segment. It descends inferiorly and becomes more lateral. This segment gives off 2 branches-the nerve to the stapedius muscle and the chorda tympani. The digastric ridge and tendon is posterior,

inferior and superficial to the facial nerve. It then exists from the stylomastoid foramen and passes into the substance of the parotid gland to supply the muscles of facial expression.

The surgical landmarks useful for the identification of the tympanic and mastoid segments of the facial nerve from the mastoid approach are the lateral semicircular canal, fossa incudis and the digastric ridge. According to Nelson and other authors, the 2nd genu of the facial nerve courses anterior and medial to the dome of the lateral semicircular canal. Similarly, our study found that the facial nerve coursed anterior (100%) (fig. 1) and medial (66%) (fig. 2) to the lateral semicircular canal.

The facial nerve was consistently found 1 to 2 mm medial to the lateral semicircular canal as compared to the level of the diagnostic ridge where it was found to be more variably located from 1 to 6 mm medial to this landmark. These findings confirms the statement of Cass that the lateral semicircular canal is the most important landmark in mastoid surgery because it defines both the anteroposterior and the mediolateral location of the facial nerve and it is the first surgical landmark to be developed.[3,10]

Furthermore, the digastric ridge helps to define the distal mastoid segment and the stylomastoid foramen [3]. As far as variations are concerned, it may occur within any portion of the temporal bone. Developmental arrest or aberration is responsible for much of these variations that is of consequence to the surgeon. [5] In our review of literature, we were able to find several aberrant courses of the facial nerve:

1. Facial nerve located superior to the horizontal canal[11]
2. Coursing through the crura of the stapes[11]
3. Embracing the crura of the stapes[17]
4. Coursing over the oval window[11]
5. Coursing anterior to the oval window[16]
6. Coursing between the oval and round window[1,2,11,113,16,17]
7. Coursing over the promontory[1,2,11]
8. Situated in the external bony ear canal without bony protection just below the skin 2-3 mm lateral to the tympanic membrane. [8]
9. Bifurcations, [1,11,16] trifurcations[1,11,16] and hypoplasia[11,16] of the facial nerve have been found within the mastoid segment.

In the 50 temporal bones that we have dissected, we were not able to find any of the above-mentioned anomalies. In this study the following variations of the facial nerve were noted:

1. In 3 temporal bones, lateral displacement at the level of the semicircular canal.
2. In 14 temporal bones, in the same level with the lateral semicircular canal.
3. In 2 temporal bone, lateral displacement at the area of the digastric ridge.
4. Another variant noted was posterior of the 2nd genu of the facial nerve in 1 temporal bone, which according to Schuknecht and other authors is the most common abnormality seen within the mastoid segment. [2,11,16]

The presence of these anomalies may trap the unwary otologic surgeon who relies strictly on conventional surgical landmarks.

CONCLUSIONS

1. The lateral semicircular canal and digastric ridge remain practical and reliable surgical landmarks in identifying the facial nerve. However, the lateral semicircular canal is still more consistent.
2. Variations in the course of the facial nerve are most commonly found in the mastoid segment as seen in 20 dissected temporal bones.
3. Although the otologic surgeon must be familiar with the normal route of

the nerve, he must be cognizant that the hallmark of the temporal bone is variation and he must consequently anticipate changes from the usual relationships with which he is familiar.

RECOMMENDATIONS

The group recommends that this study be performed in a larger population so as to come up with a more representative data. Data from children and adolescent group should be collected since the majority of patients who undergo mastoidectomy belong to this age group. It is our hope that an honest self-appraisal with regard to the knowledge of facial nerve anatomy will be stimulated as a result of this study.

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Original Study

Effects of Organophosphates on Rabbit Nasal Mucosa

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One of the most widely used pesticides at present is an organophosphate phenthoate. On inhalation, most of its residues are deposited on turbinates. This experimental study deals with the demonstration of changes in the nasal mucosa of rabbits caused by inhalation of Phenthoate and determination whether these changes are due to local or direct effect or systemic in origin. Twenty rabbits were used and divided in to 4 groups. All exposed to vapors of Phenthoate and one group being sacrificed every 30 days for a period of 3 months. RBS acetycholinesterase level depression was determined using Michel method. The lateral nasal wall was harvested and sent for histopathological study. Several changes were noted in the nasal mucosa in the exposed animals. Initial changes noted are deciliation, presence of inflammation, loss of cellular architecture, vacuolation, and intercellular edema. Metaplastic changes were noted in the group with the longest exposure. Early changes were noted in the anterior portion of inferior turbinate being the most exposed among the sections studied. Organophosphate-induced mucosal mucosal transformation is due to the direct effect of organophosphate and not secondary to systemic absorption.

INTRODUCTION

Pesticides are chemicals used to control pests, weeds, or plant diseases. They are widely used in agriculture and in public health programs as vector control agents. Some are being used in forestry and livestock production. These chemicals may be extracted from plants or may be synthetic. Synthetic pesticides are formulated products composed of an active ingredient combined with impurities and inert substances.

Pesticides are non-selective, that is, they harm organisms other than their targets. Acute toxicity may develop from accidental occupational exposure or deliberate intent. There is now a heightened awareness of the potential long-term toxic effects of either an acute or a chronic exposure to these chemicals. The role of pesticides in mutagenesis and carcinogenesis and their possible toxicity to the nervous and reproductive systems are important areas of concern.

Despite their hazardous properties, pesticides are currently an indispensable component of agricultural practice throughout the world and also make a major contribution to the control of insect vectors of many tropical countries.

One of the routes by which pesticides enter the body is through inhalation. These pesticides could have a direct effect on the nasal mucosa in which filtration being one of its significant functions. Several types of pesticides are noted to have a direct effect on the nose, particularly the olfactory mucosa. Mancuso, Giovanti, et al. [1] have documented the tissue-specific including necrosis of herbicide Dichlobenil following an intraperitoneal injection. Mucosal changes ranges from vacuolations and necrosis of Bowman's glands to total damage of the lamina propria. Pool-

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Zobel, et al. [2] have demonstrated the DNA-damaging activity of insecticide Lindane. They concluded that Lindane was genotoxic in cells of the gastric and nasal mucosa in vitro and in vivo following appropriate route of application – oral and inhalational exposure. Stoot et al. [3] have investigated the effect of a soil fumigant, 1,3 dichloropropene (DCPT) in rats after 13 weeks of exposure. They have noted that the primary target tissues of inhaled DCPT was the nasal mucosa; in addition, they recorded a decrease in growth rate in all animals exposed.

A dose-related degenerative effect on nasal olfactory epithelium and a mild hyperplasia of the respiratory epithelium were note especially in the high exposure group (150 ppm DCPT vapors, 6 hours/day, 5 days a week, 17 weeks). Lee, K.P., et al. [4] in 1982 have tabulated the changes in nasal epithelium in rats exposed to HMPA (hexamethyl-phosphoramide) by inhalation. This investigation revealed nasal tumors and squamous metaplasia. The ciliated cells were most susceptible to degenerative changes with abnormal cilia and extensive deciliation.

Finally, Liska-Markiel et. al. [5] in 1990 have evaluated the status of nasal mucosa in workers engaged in the production of chlorfenvimphos. They noted a higher prevalence of nasal mucosa change of inflammatory or allergic character among these workers. Olfactometric study reveals lowering of odors sensation and identification threshold.

In our country, there are only 13 currently registered organophoshate in the Philippine Fertilizer and Pesticide Authority such as chlorpyrifos, diazinon, dichlorvos, malathion, and phenamiphos to name some. One of the most widely used organophosphate in the country is phenthoate (0,0 dimethyl-5 (d-ethoxycarbonylbenzyl) – phosphorthoate). It is popularly used in paddy rice, cabbages, tobacco, soybean, citrus fruits, tea, and cotton plantations. This chemical comes in a clear brown liquid form and has a specific gravity of 1.02 at 20 C and flash point of 27 C. It forms an emulsion when mixed with water. It belongs to FPA Hazard Category II with lethal dose (LD50) of 878 mg/kg, dermal LD50 (rabbit) > 10,000mg/kg and acceptable drug intake (ADI) of 0-0.003. Inhalation LD50 for 4 hours exposure is not yet available. Its main metabolites are phenthoate acid and demethyl-phenthoate oxon acid.

Absorption occurs by all routes of exposure – inhalation, dermal, and ingestion. It interfere with the action of acetylcholinesterase rendering RBC acetylcholine inactive. The value of which determines the systemic absorption of this organo-phosphate.

Different types of epithelial cells are known to be present throughout the lateral nasal wall. The epithelium of the inferior turbinate especially the anterior tip is non-ciliated while farther back the epithelium becomes ciliated. Under ordinary circumstances, the nose is the first target for airborne attack and hence the first defensive line against ambient air, characterized by unphysiological temperature and humidity, and the presence of microorganisms and impurities. Most of the inhaled pesticides are deposited on the anterior third of the inferior turbinate.

In this study, mucosal biopsy specimens were taken after predetermined exposure with phenthoate to demonstrate the changes in the nasal mucosa and to correlate them with the degree of exposure. In addition, this study investigated whether the mucosal changes could be attributed to local effect of phenthoate or to its systemic effect through the measurement of RBC cholinesterase levels.

MATERIALS AND METHODS:

Preparatory Phase

20 rabbits kept in acrylic transparent cages were grouped into four. Five rabbits each were allocated into 1 control group and 3 experimental groups. Phenthoate solution prepared by mixing 1 teaspoon of the pesticide to 4 liters of water.

The experimental groups were exposed to phenthoate spray 2 hours/day for 30 days (Group I), 60 days (Group B)

and 90 days (Group C). Animal food was removed during the spraying to prevent food and water contamination and to assure that the entrance of the pesticide to the subject's body will be through inhalation only.

Blood Collection Phase

After the designated duration of exposure, 5 cc of blood was obtained from all experimental animals. Blood samples were placed in a heparinized test tube, maintained at 0-5 C and processed for RBC cholinesterase level determination using Michel Method.

Specimen Collection and Evaluation Phase

All animals were euthanatized with thiopenthal IM injection followed by vecoronium IM. The whole lateral nasal wall was incised using sharp blade 15 to minimize trauma to the turbinates. The lateral nasal walls were immediately placed in formalin solution and processed for histopathologic examination.

The anterior tip of inferior , middle and superior turbinates were excised from the rest of the lateral nasal wall and marked specimen A, B and C, respectively. All specimen slides were stained with hematoxylin and eosin and evaluated by three independent pathologists who graded each slide for degree of deciliation, epithelialization or deciduation, inflammation, mild to moderate edema, severe edema, and squamous metaplasia. Furthermore, the pathologists were blinded to the particular site where the specimens were taken and to the duration of exposure.

Statistical Analysis

T test was used to compare the degree of cellular injury among the sites exposed, namely, the anterior portions of the inferior, middle, and superior turbinate. Coefficient of correlation was obtained to establish the association between the amount of organophosphate absorbed and degree of cellular injury.

RESULTS

The nasal mucosa of the control group was made up of ciliated stratified columnar epithelium 10 to 15 cells thick. The basal layer was low columnar or cuboidal. The surface epithelium cells had uniformly arranged cilia and polarity of the nucleus at the base. Little or no inflammatory infiltrates were seen in the mucosal layer.

The nasal mucosa of the exposed rabbits had cellular vacuolation more pronounced on the site of contact – the apical layer (Fig.1). In addition, there was loss of cellular orderly arrangement. Blunting or flattening of the surface was seen due to the loss of cilia (Fig.2).

Further exposure of the rabbits to organophosphate decreased the cellular stratification to 4-5 cells thick. Cells in all layers of the mucosa were haphazardly arranged and admixed with inflammatory infiltrates. Necrotic cells were noted at the topmost level, appearing as eosinophilic material (Fig.3).

Sloughing of the apical layer was evident in some sections (Fig.4). In the last group of subjects, the surface epithelium changed from stratified squamous to squamoid type particularly in the anterior portions of the turbinates (Fig.5).

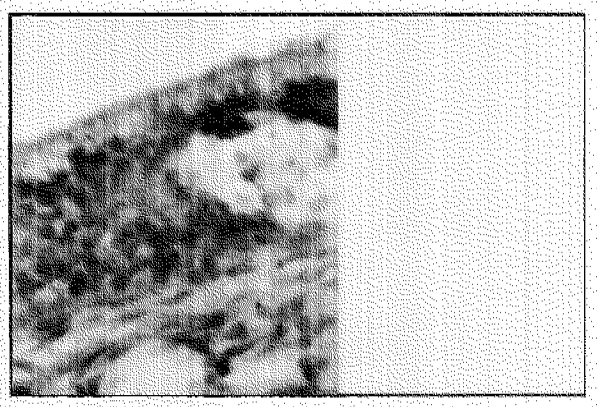

Fig. 1. Initial vacuolation of nasal epithelium after exposure

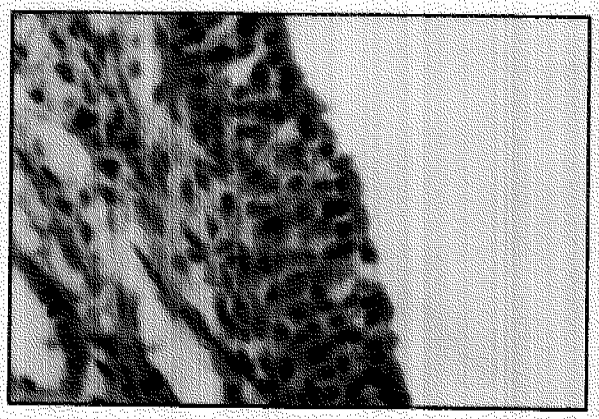

Fig. 2 Flattening of nasal epithelium

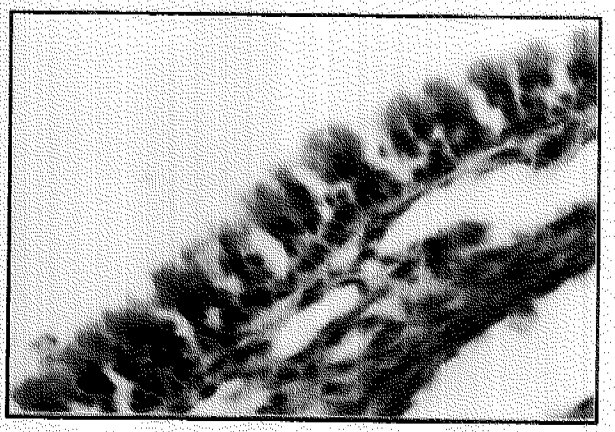

Fig. 3 Separation of necrotic apical layer

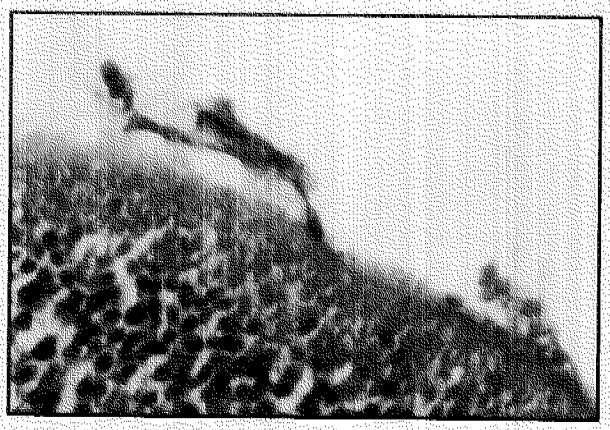

Fig. 4 Sloughing off of mucosa

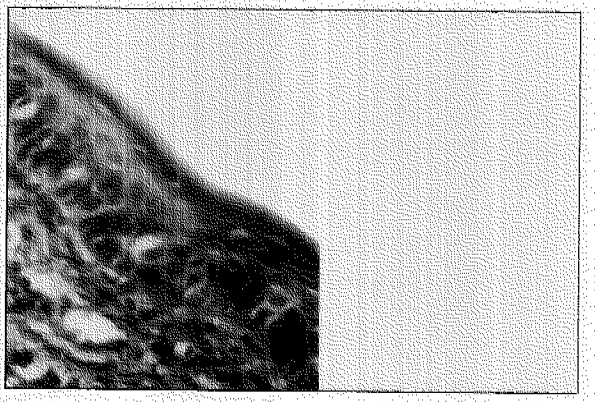

Fig. 5 Squamous metaplasia at inf. turbinate

Table 1. Grading of Cellular Injury

GRADE	Deciliation	Epithelialization	Inflammation	Mild-moderate edema	Severe edema	Metaplasia
1	+	-	-	-	-	-
2	+	+	-	-	-	-
3	+	+	+	-	-	-
4	+	+	+	+	-	-
5	+	+	+	+	+	-
6	+	+	+	+	+	+

Table 2. Injury Grading by Duration and Area of Exposure

Group A (30 days)	**Inferior**	**Middle**	**Superior**
Pathologist			
1	4	3	2
2	5	4	3
3	5	4	3
Group B (60 days)*			
Pathologist			
1	5	3	2
2	4	2	2
3	5	4	4
Group C (90 days)**			
Pathologist			
1	6	4	4
2	6	2	3
3	6	4	6

* significantly different grading between inferior and middle turbinates and between inferior and superior turbinates ($p<0.05$)
** significantly different grading between inferior and superior turbinates ($p<0.05$)

Table 3. RBC Acetylchholisterase Levels and Injury Score by Specimen Site

	RBC Acetylcholinesterase level depression	**Injury Score by Specimen Site**		
		Inferior	**Middle**	**Superior**
Control	0.187 pH/hr	0	0	0
Group A (30 days)	0.05 pH/hr	4.7	3.7	2.7
Group B (60 days)	0.02 pH/hr	4.7	3	2.7
Group C (90 days)	0.01 pH/hr	6	3.3	4.3
R value		-0.71	0.24	-0.68

DISCUSSION

The degree of injury of pesticide Phenthoate to the nasal mucosa of the experimental animals followed a gradient. Progressive epithelial damage was observed with the inferior turbinate, where there was a direct exposure to the unfiltered phenthoate vapor, demonstrating the greatest destruction and the superior turbinate the least at different durations of exposure.

The mildest form of damage was deciliation as a consequence of the disintegration of the cytoskeleton. Distortion of the surface cilia resulting to blunting of the epithelium was observed in all sections. This presumably has a tremendous effect on the mucociliary clearance leading to the failure of the nose to filter out damaging substances. A vicious cycle of pesticide accumulation and cellular injury followed by cellular death ensues.

The shedding of the outermost cells of the nasal mucosa due to continuos death of the stratified epithelium resulted from the deterioration and loosening of

intercellular attachment. Cells lost their characteristic stratification. De-epithelization or deciduation follows.

Necrotic cells detached from the surface epithelium were seen in most of the specimens. These necrotic cells protruded into the airway and were subsequently removed by cellular reparative processes.

Epithelial linings exposed to phenthoate were thinner (up of 3-5 cells thick) than normal epithelium (8-15 cells thick). The reduction of the mucosal height was due to higher rates of cellular death in the upper level and failure of the basal layer to keep up with the demanded replacement. The destroyed ciliated cells were unable to repopulate because of aberrant cellular differentiation, metaplasia and continuous cellular injury. Several studies have pointed out the absence of ciliated cells in epidermoid nasal carcinoma, in carcinoma-in-situ of the bronchus, in cancer of the trachea induced by chemical carcinogens, and in bronchial epithelium exposed to dust and chemicals.

Cellular swelling in the form of vacuolation is due to formation of cytoplasmic blebs. This is a manifestation of almost all forms of cellular injury when cells are incapable of ionic and fluid homeostsis. These vacuoles represent distended and pinched off or sequestered segments of endoplasmic reticulum.

The decreasing gradient of cellular damage from anterior to posterior areas and from inferior to superior turbinates demonstrates the efficient filtration function of the turbinates. The degree of pathologic changes such as epithelial shedding, protrusion of epithelialization or deciduation, and intercellular edema was significantly higher in the anterior areas than in posterior and superior areas.

Barnes suggested that patchy epithelial damage may be produced by basic proteins derived from eosinophils, or by oxygen radicals released by various inflammatory cells. Thus, increased inflammatory infiltrates significantly produce further mucosal destruction. Gleich et al. [6] reported in 1979 the cytotoxicity of eosinophil major basic protein. In 1977, Watanabe et al [7] emphasized that eosinophil peroxides, one of the proteins in the cytoplasmic granule, leak out of the cell and adhere to nasal epithelium. In 1998, he further observed that these eosinophils migrate to nasal epithelium and form clusters where epithelial shedding was most conspicuous.

Metaplasia is a reversible change in which one adult cell type (epithelial or mesenchymal) is replaced by another adult cell type. The general prevailing concept is that metaplastic cells are derived from undifferentiated basal or reserve cells rather than from direct transformation of an adult columnar cell into an adult squamous cell. The nasal epithelium was subjected to continuos remodeling by destruction and repair process during phenthoate exposure. The damaged respiratory epithelium was repaired initially by undifferentiated mucus cells and microvillous cuboidal cells. In the ensuing period, the superficial cells were replaced with squamous cells migrating from the basal layer, resulting in stratified squamous epithelium.

The degree of acetylchlinesterase depression reflects the amount of organophosphate absorbed by the experimental animals. Organophosphate inhibits acetylcholinesterase resulting to accumulation of acetylcholine. RBC acetylchlinesterase will only be replenished by the production of new RBC and subsequent removal of the organophosphate. Most of the experimental rabbits exhibited an inverse relationship between the level of acetylcholinesterase and the distance from the anterior areas of the inferior turbinate. Thus, the effect of the organophosphate on the nasal mucosa is primarily due to direct contact to the surface. Massive destruction of surface epithelium was observed prior to submucosal changes seen in the last group.

CONCLUSION

The deleterious effect of phenthoate on the nasal mucosa of rabbits was clearly seen in this investigation. These effects, namely, deciliation, vacuolation, intercellular edema, loss of cellular architecture, and de-epithelialization,

follow a gradient more pronounced in the most exposed part of the nasal cavity examined – the anterior portion of inferior turbinate. Prolonged exposure to this toxic substance leads to involvement of the whole nasal cavity. Eventually, squamous metaplasia develops as a protective mechanism against the noxious substance but such transformation exerts deleterious effects on nasal functioning. Organophosphate-induced mucosal transformation is due to the direct contact and not as a result of systemic absorption.

RECOMMENDATION

Studies on the effect of chronic organophosphate expoosure on farmers can be done to stress the importance of its careful handling, manufacture, and use. The status of mucociliary clearance of the farmers exposed can be assessed. In addition, effects of organophosphate on other cellular elements like the mucin glands and olfactory epithelium can be done. Longer exposures of the rabbits may be done to note the development of various types of nasal tumors.

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The Use of theTemporalis Fascia Flap in Canal Wall Down Mastoidectomy

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Objective: To describe the single-stage canal wall down mastoidectomy combined with the inferiorly-based temporalis fascia flap technique after open mastoid surgery for chronic tympanomastoiditis with cholesteatoma formation.
Design: Case series
Participants and intervention: Three (3) patients with chronic tympanomastoiditis with cholesteatoma undersent single-stage open mastoid surgery combined with an inferiorly-based temporalis fascia flap technique.
Results: All subjects had dry ears, intact tympanic membranes and improvement in hearing.
Conclusion: The single-stage open mastoid surgery combined with the inferiorly-based temporalis fascia flap technique was effective in the eradicating tympanomastoiditis, promoting epithelialization in the mastoid cavity and restoring a functional tympanic membrane.

INTRODUCTION

Chronic otitis media is one of the most common diseases encountered in the outpatient clinic. Its infectious complications---acute and chronic mastoiditis with or without cholesteatoma formation, petrositis, and intra-cranial infection---still occur despite the widespread use of antibiotics for the disease. The non-infectious sequelae, such as chronic perforations of the tympanic membrane, ossicular erosion, and labyrinthine fistula are significant causes of hearing loss throughout the world [1].

Most patients with cholesteatoma consult a physician because of draining ears that, when improperly diagnosed, are sent home with the usual prescription of "aural toilette" combined with topical and/or systemic antibiotics. It is only when recurrent episodes of otorrhea prompt these patients to once again seek consult that a definitive plan for mastoid surgery is made.

Mastoidectomy must adequately remove diseased tissues while preserving normal anatomy. Although various mastoid techniques have been employed in the treatment of chronic suppurative otitis media, majority of otolaryngologists agree that a meticulous, single-stage canal wall down technique (CWD) in ears with extensive cholesteatoma frequently results in stable, unproblematic ears with satisfactory function. The introduction of the canal wall-up technique (CWU) by posterior tympanotomy appeared to be a significant advancement in the

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treatment of ears with extensive cholesteatoma [2]. However, later results that in CWU technique, *recurrent or residual cholesteatoma is the rule more than the exception* [3]. Other authors claim that preservation of the posterior canal wall appears *a priori* to be risky as it may result in deep retraction pockets and later on recurrent cholesteatoma [9]. Thus most ENT surgeons prefer the CWD, open cavity operation and consider it as the safest and simplest means for eradicating middle ear cholesteatoma.

The main disadvantage of CWD technique is persistent or recurrent discharge from the middle ear and mastoid cavity. In the classical radical mastoidectomy, epithelial regeneration is left to nature and involves spontaneous advancement of epithelium from the adjacent skin edges over the entire bony cavity. Cessation of post-operative discharge may be inhibited by many factors. A large irregularly shaped and poorly fashioned cavity (since bony overhangs may increase the incidence of post-operative discharge), open mesotympanum which leave the middle ear exposed to infection and shortcomings in after-care and lack of sterile precautions in the early post-operative period may lead to recurrent otorrhea after surgery.

Hence, several attempts have been made to secure a well-epithelialized post-operative mastoid cavity. Split-thickness skin grafts and later full-thickness skin grafts have been utilized to line the cavity after tympanoplasty. However, survival of the skin on sclerotic bone proved to be difficult due to the inadequacy of blood supply. Non-epithelial tissues, such as periosteum, fascia, and temporalis fascia have also been used to cover the bony cavity and provide a more favorable foundation for spontaneous proliferation of skin. Occasionally, grafts might fail to survive probably due to inadequate blood supply. On the other hand, pedicled flaps have shown great versatility in reconstructing head and neck defects of which the CWD mastoidectomy cavity is one. Thus we report our use of an inferiorly pedicled temporalis fascia flap in conjunction with tympanoplasty to obtain a dry and possibly functional ear.

SUBJECTS AND SURGICAL TECHNIQUE

Three patients seen in the outpatient department of our tertiary hospital from December 1997 to September 1998 were selected. The patients complained of ear discharge for an average of fourteen months with otologic and radiologic assessments that were consistent with chronic tympanomastoiditis with cholesteatoma formation. They had no history of otomastoid surgery or any signs and symptoms of complications such as headache, vertigo, facial paralysis, neurologic deficits, etc.

Pure tone audiometry was conducted to evaluate hearing acuity. All operations were performed in one stage using the canal wall down mastoidectomy combined with the inferiorly based temporalis fascia flap technique.

The first case was J.Y., a 24 year old female, consulted the OPD due to bilateral ear discharge for the past 13 months. Otoscopy revealed an attic perforation on the right eardrum. Towne's view demonstrated hazy mastoid cavities and a radiolucent area with sclerotic borders on the right mastoid. Pure tone audiogram revealed bilateral moderate conductive hearing loss.

The second patient was N.B., a 32 year old male with scanty, foul smelling left ear discharge for the past 11 months. Otoscopic examination showed a near total perforation with a pearly white mass within the middle

ear. Pure tone audiogram revealed mild to moderate conductive hearing loss, left.

The third case was T.S., a 19 year old female with foul smelling, mucoid discharge on the right ear for 16 months. Otoscopy revealed a near-total perforation of the right tympanic membrane. Towne's view revealed cholesteatoma on the right mastoid. Pure tone audiogram revealed moderate conductive hearing loss.

The standard post-auricular incision was extended vertically upwards for 2.5 cms. to provide wide exposure of the mastoid and temporalis fascia. A large, tongue-shaped fascial flap, based inferiorly was then developed and elevated from above downwards as far as its attachment along the lower border of the temporalis muscle. (Fig. 2)

The flap was then sharply dissected to release its deep surface and continue further elevation subperiosteally down to the mastoid tip. The periosteal segment of the flap was kept as broad as required to line much of the mastoid cavity. The pedicle of the flap, at least 2 cm. wide, was located over the mastoid tip and contained the main feeder vessel, the postauricular artery, which was carefully identified and preserved. The flap was wrapped in moist dressings during the subsequent mastoidectomy.

After mastoidectomy, an adequately wide meatoplasty was carried out. The flap was swung forward and spread out to cover the entire mastoid cavity, leaving no areas of exposed bone, while the free fascial extremity of the flap was inserted beneath the drum remnant as an underlay graft to repair the perforation.

The reconstructed eardrum was protected with a thin layer of Gel foam. A gauze ribbon impregnated with providone-iodine ointment was used to pack the mastoid cavity. The packing was left undisturbed for at least three to four weeks. Oral antibiotics were given routinely. All patients were asked to follow-up weekly for the first post-operative month, then monthly for the succeeding visits.

RESULTS

In all three patients, cholesteatoma was encountered. The average follow-up period was eight months. All three had dry mastoid cavities and intact tympanic membranes. Air conduction thresholds were improved by 10 to 20 dB and the average air bone gaps decreased by 10 to 20 dB after surgery.

DISCUSSION

The inferiorly based temporalis fascia is a composite flap, composed of temporalis fascia superiorly and periosteum of the outer mastoid cortex inferiorly. Its pedicle is near the mastoid tip and is based on the mastoid branch of the posterior auricular artery, a branch of the external carotid artery. The flap can be rotated forward into the defect and is large enough both to line the entire mastoid cavity and repair the tympanic membrane.

The posterior auricular artery is situated in the groove between the external ear and the mastoid process [4] (Fig. 1) This approximate location of the posterior auricular artery was confirmed in cadaver dissections done by Gibb, et.al. who injected methylene blue into the posterior auricular artery. Although there was no evidence of vascular continuity between the fascial and periosteal components of this flap, the authors recognized that microanastomosis may exist without showing up in the dye studies. These findings were confirmed by K. Tan in 1997 who reported extensive

anastomosis between the fascial and periosteal segments of the flap during live surgery.

CONCLUSIONS

In all of our cases, the use of the inferiorly-based temporalis fascia flap showed some merits. This report, however, does not preclude the superiority of this technique over other methods of mastoid surgery mainly because of the limited series of cases at present.

While we regard the results as purely preliminary, we are convinced that the technique has considerable merit in establishing a "sound and quiet" ear. The authors believe that the use of this technique is ideal in our local setting where patient compliance is unsatisfactory and a one-stage procedure is most often necessary. Furthermore, the use of a pedicled flap is more advantageous than a free graft because of the presence of ample and definite blood supply. Hence, the chances of re-epithelization of the mastoid cavity are better. An important benefit to the patient is the improvement of hearing which is not an expected finding in open mastoid surgery. Lastly, the routine use of this flap might address the problem of coverage of dehiscences in the tegmen tympani and lateral sinus plate.

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Reconstruction of a Wide Palatal Defect using Radial Forearm Free Flap

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Surgical removal of head and neck tumors can leave potentially debilitating defects that make the patient's life more miserable than it used to be. Local as well as pedicled flaps can close these defects, but it has limitations. The advent of microvascular surgery and free tissue transfer has revolutionized the reconstruction of most extensive defects. The redial forearm fascio-cutaneous free flap has become a popular choice for reconstruction because of its unique features. Being a relatively thin and pliable flap, it is malleable and can be configured to a variety of shapes and sizes. It has found many uses in the reconstruction of oral and pharyngeal defects. It is cosmetically and functionally acceptable because of its relative lack of hair. Because it can be used as a sensate flap, it can facilitate the return of swallowing function. The flap is likewise easy to harvest. In this paper, this flap was used as an alternative to an obturator prosthesis in separating the oral cavity from the sinu-nasal cavities. The advantages of using the radial forearm free flap are presented.

INTRODUCTION

Microvascular free tissue transfer to the head and neck has become an accepted method of reconstruction owing to the increased success rate and superior aesthetic and functional results. The radial forearm free flap has particularly stood out as an excellent choice for closure of defects owing to its lack of bulk, ease of dissection, vascularity and malleability. It has enjoyed numerous applications in the closure of most oral and pharyngeal defects[1]. Moreover, the inclusion of a nerve in the flap tissue enables the return of swallowing function. This paper presents the application of the radial forearm fascio-cutaneous flap in separating the oral cavity from the sinu-nasal cavities after total removal of the hard palate and adjacent structures. The paper presents an alternative to placement of obturator prosthesis for extensive defects of the maxillary infrastructure.

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SUBJECTS AND SURGICAL TECHNIQUE

The patient was a 64 year old female diagnosed with a stage III (T3N0M0) moderately differentiated squamous cell carcinoma of the hard palate confirmed by punch biopsy. CT scan of the hard palate and paranasal sinuses showed tumor growth in the hard palate with extension into the right maxillary sinus and inferior turbinate. The patient was subjected to complete course of radiotherapy directed at the primary lesion upon the recommendation of a previous doctor. However, there was no response to this form of treatment. On admission, the

patient was placed on gastrostomy tube feeding prior to the operation. Routine pre-operative evaluation was done. The Allen test (Fig. 1) showed good vascularity of the thumb and index finger.

At the operating room, the entire hard palate including the alveolar ridge and almost the whole of the soft palate was excised *en bloc*. Wide resection included part of the right maxillary sinus, the right inferior turbinate, and the bony as well as cartilaginous nasal septum (Fig. 2). The margins of the resection were submitted for frozen section which later revealed no evidence of malignant involvement.

The dimensions of the defect were measured. Meanwhile, a second surgical team harvested a skin paddle from the volar surface of the left forearm. The size of the skin paddle was based on the measurements earlier made. A longer than usual vascular bundle consisting of radial artery and venae comitantes was included in the dissection, taking note that the vessels be anastomosed end to end with the donor vessels at the mid-neck. Initial flap insetting was done (Fig. 3).

An imaginary line drawn in the middle of the flap was de-epithelialized. The flap was then folded over itself sandwich-like. The nasal surface of the flap was sutured over the defect using Dexon 4-0 absorbable sutures and the same was done on the oral cavity portion. The insetting therefore resulted in a flap that was lined by skin on both nasomaxillary and palatal sides.

The vascular pedicle of the flap was then tunneled through the buccal space superficial to the mandible. At the neck, the flap vessels were anastomosed with the superior thyroid artery and common facial vein. The closure was completed, creating a water-tight seal. The donor site was closed with a split thickness skin graft harvested from the skin on the medial side of the left thigh. A plaster of Paris cast was used to immobilize the entire left arm where the graft was harvested.

The patient's post-operative course was unremarkable. The patient was discharged eleven days after the operation.

DISCUSSION

Since its introduction two decades ago[1], the radial forearm free flap has enjoyed wide acceptance as the fascio-cutaneous flap of choice for reconstruction of most oro-pharyngeal defects. Its thin, pliable and predominantly hairless forearm skin has proven to be versatile in a variety of reconstructive situations.

Several tertiary centers have used the radial forearm flap for this application[2,3,4]. However, very few have attempted to close extensive defects in the palate with this flap. The "infrastructure" of the maxilla[4], which includes the hard palate, the pre-maxilla and the alveolar ridge, can be included in extensive and wide resections that create free communication between the oral and nasal cavities. Such procedures are not satisfactorily repaired by placing a prosthesis. Since the whole hard palate, including the entire alveolar ridge and part of the soft palate was removed, no structure would hold an obturator prosthesis in place.

Osteo-cutaneous flaps can be used to close extensive palatal defects. Urken[2] published a review of 200 cases which have undergone reconstruction with micro-vascular free flaps. In this review four cases required palatal reconstruction using scapular osteo-cutaneous flaps. Two of these flaps eventually succumbed to flap ischemia associated with wound infection. It was postulated that failure to create a water tight seal lead to the contamination of

the flap with secretions coming from both the nasal and oral cavities.

The palate serves an important role in maintaining a separate nasal and oral cavity essential to good speech and effective deglutition. Extirpative surgeries in the region of the maxilla tend to violate this separation. Small defects and fistulas are amenable to primary closure as well as local flaps.

Partial and total maxillectomies create larger defects that can be closed with surgical obturation. Pedicled flaps from the forehead as well as the temporalis muscle can also be employed. However, because of its limited arc of rotation, the latter may not reach all areas of the head and neck. The unnecessary bulk as well as the need for a second procedure also limits the use of this technique. Pedicled flaps also result in significant donor site morbidity.

The use of dental appliances like obturator prosthesis offers a solution for procedures that remove much of the maxillary infrastructure. A thorough pre and postoperative evaluation by a prosthodontist is needed in these cases. Else, ill fitting prostheses occasionally end up not being used at all.

The authors gained several advantages from using a radial forearm free fascio-cutaneous flap in the closure of a near total palatectomy defect. Since bulk is not required in order to achieve oro-nasal separation, the radial forearm flap is an appropriate chooice. Its flexibility and ability to conform to specific shape and size requirements make it ideal for other areas in the oral cavity and pharynx. Its capacity to develop sensory innervation facilitates return of swallowing function.

There were no infectious complications in either the flap or the donor site of the patient just presented. The patient was able to maintain a distinct oral cavity completely separate from the naso-maxillary cavity.

In spite of some sagging of the flap into the oral cavity a few months after the procedure, such a problem did not interfere much with the patient's deglutition. This is where the advantage of an osteo-cutaneous flap comes in. Since the hard palate consists of bone and skin, the scapular osteo-cutaneous flap can be used as an alternative to obturator prosthesis. The bony component will serve to restore the contour of the midface.

CONCLUSION

In this paper we have demonstrated the application of the radial forearm flap in covering an extensive defect and in separating two cavities in order to maintain speech and swallowing. We have discussed the case of a patient who underwent extensive palate surgery due to stage III squamous cell carcinoma. A relatively simple reconstructive procedure where the value of a free flap without bulk was realized. Although some sagging of the flap into the oral cavity occurred post-operatively, the swallowing function was not affected. Likewise, a watertight oro-nasal separation was achieved.

RECOMMENDATIONS

Basing on the experience gained from this procedure, the following recommendations can be made:

1. In order to prevent sagging of the mostly cutaneous flap into the oral cavity, the flap should be suspended from the nasal septum. However, injury or undue tension to the flap vessels should be avoided.
2. The ideal free flap for naso-maxillary defects is one that contains a bony component, like the scapular osteo-cutaneous flap. This flap has a capability of being conformed in a three dimensional manner because

of it's bony as well as two skin island components.

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SPID Lite (System for Portable and Inexpensive Delivery of Light): An Adaptor for Endoscopic Illumination

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The inaccessibility of the orifices of the head has always posed a great challenge to the practicing physician. Telescopes have been integral for visualization, but general practitioners, pediatricians, otorhinolaryngologists, and allied specialists alike, may find these instruments too costly. Thus, the quest for inexpensive, practical, and portable instruments has always been a prime concern. Telescopes require a light source and an additional device to deliver this light to the telescope. To date, only two systems are available for light delivery: cable-assisted lighting from a light source via a light cord (fluid-filled type of fiber optic type) and direct lighting, where a hand-held light source fits directly onto the telescope fiber optic port, thus obviating the cord. These two light delivery systems are nevertheless expensive, costing anywhere between US$20 for the hand-held light source to US$2,000 for a light source and US$300 for the cord.

An improvised light delivery system---SPIDLite: System for Portable Inexpensive Delivery of Light--- was made from a modified surgical suction tubing. This improvised adaptor was used to attach a telescope to a conventional otoscope that served as a modified light source. Llight was delivered directly to the scope via the improvised adaptor. The device was a simple, practical, and inexpensive alternative to the more costly light source and cords, and delivered a brighter illumination than the commercially available hand-held light sources.

Introduction

The diagnosis and management of head and neck diseases has been a great challenge for the practicing physician, particularly, the otolaryngologist-head and neck surgeon, because the orfices of the head are relatively inaccessible. However, the advent of telescopes has made this impediment a thing of the past. Telescopes have since been standard instruments for visualiza-tion.Nitze, in 1879, designed the conventional lens system for telescopes, which was initially employed as a cystoscope. Almost 100 years passed until Hirschmann, utilizing a modified cystoscope performed the first nasal endoscopy. Since then, major advances in optics, biomechanics, and radiographic imaging have allowed the otolaryngologist-head and neck surgeon to evaluate and treat disorders with greater precision. These instru-ments permit direct visualization of the ear, nose and paranasal sinuses, pharynx, larynx, tracheobronchial tree, and esophagus leading to more accurate diagnoses, and thus offering better patient care than ever.

In 1966, the Storz-Hopkins system provided the first crucial breakthrough since the development of the conventional lens. It employed special glass rods and integrated fiber optic light transmission into the system, revolutionizing endoscopic examination with brighter illumination and sharper images. The development of fiber optic lighting has made photo-documentation a reality.

To provide the necessary illumination for endoscopy, a light source is necessarily attached to the endoscope via a light delivery system (LDS). Light sources and their corresponding LDS are as varied in cost and design. To date, only two

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systems are available for light delivery. The cable-assisted lighting features a light source that delivers light via a cord filled with either fluid or fiber optic strands. The direct lighting uses a hand-held light source that fits directly into the telescope fiber optic port, thus obviating the cord. Either way, these two light delivery systems are expensive, costing anywhere between US$20 for the hand-held light source to US$300 for the cord and an additional US$2,000 for the light source itself.

This study thus aims to develop a simple, practical, and inexpensive alternative to the costly, conventional, commercially available light sources and light delivery systems. By use of a modified surgical suction tubing, an improvised adaptor (that we called SPIDLite: System for Portable Inexpensive Delivery of Light) was fashioned to connect the conventional otoscope illuminator as a light source to the HOPKINS telescope. The authors also compared SPIDLite with currently used direct hand-held light delivery and evaluated the ease of use of SPIDLite with a questionnaire.

Materials and Instrument Design

The end of the blue tip of a surgical suction tubing was cut and the remaining stump was reduced in size to fit either of two conventional Welch-Allyn otoscopes, which would serve as a light source. For Welch-Allyn otoscope illuminator model 20000, the blue tip's original length of 3.75 cm was cut to 2.30 cm, while for the Welch-Allyn otoscope illuminator model 25257, the tip was cut to 2.05 cm (Fig. 1A and B). The resulting modified blue tip adaptor was then fitted onto either of the two models (Fig. 2).

The Storz-and-Wolf light cord housing, which is an adaptor for fiber optic light cord delivery system , was removed (Fig. 3) from a Storz-Hopkins telescope (model 7210 BWA).

The telescope was attached onto the suction tubing adaptor with otoscope illuminator as light source (Fig. 4).

The power supply for the otoscope illuminator was a Welch-Allyn No. 71062-C 3.5 v rechargeable battery (for portable type) and a Welch-Allyn No. 76722 wall transformer (for wall type). The commercially available hand-held light source was a Xomed-Treace E-Luminator II (Fig. 5), utilizing two "AA" alkaline batteries.

The light intensity delivered was measured using a Gossen Lunasix-3 light meter using four different assemblies: 1) otoscope illuminator alone (to determine the baseline); 2) otoscope illuminator with otoscope head (to determine loss of light when conventionally used as an otoscope); 3) otoscope illuminator with SPIDLite (to compare with commercially available hand held light source); and 4) complete setup composed of otoscope illuminator, SPIDLite, and telescope attachment (to determine intensity of light delivery during actual use of the modified adaptor).

Light intensity was measured in a dark room with the light meter placed at 1,2, and 3 cm away from the distalmost tip of the four assemblies.

The light intensity of the commercially available hand held light source, Xomed-Treace E-LUMINATOR II, was likewise measured. Lastly, the efficiency of light delivery between the two systems (Xomed-Treace E-LUMINATOR II SPIDLite) and was compared.

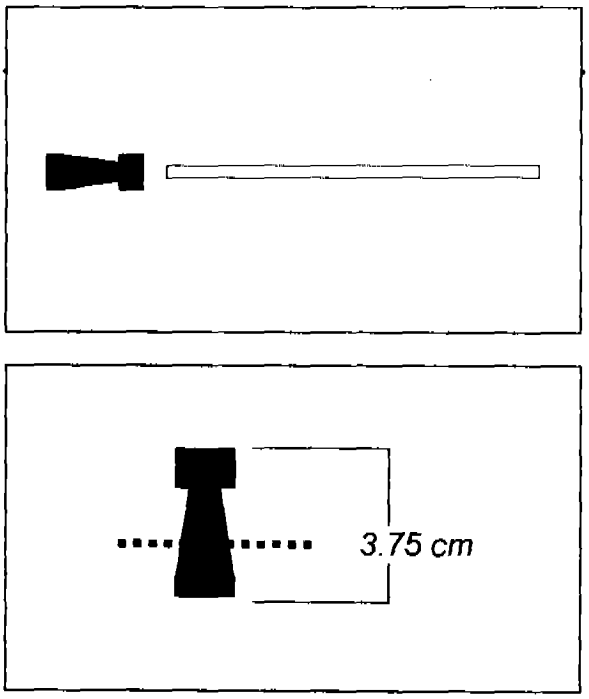

Fig 1A and B. Preparation of otoscope-to-telescope connector from blue tip of suction tubing

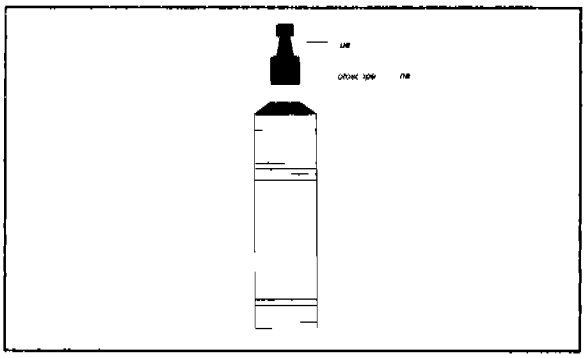

Fig 2 Blue tip of suction tubing placed on otoscope illuminator

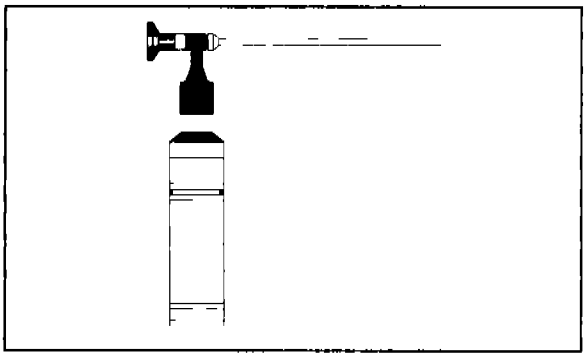

Fig 4 Completed telescope otoscope assembly

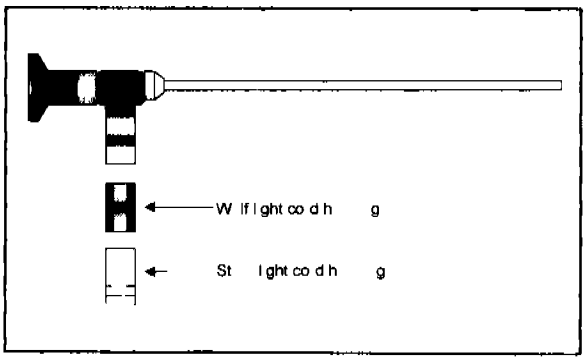

Figure 3 Storz and Wolf light cord housing unscrewed from telescope

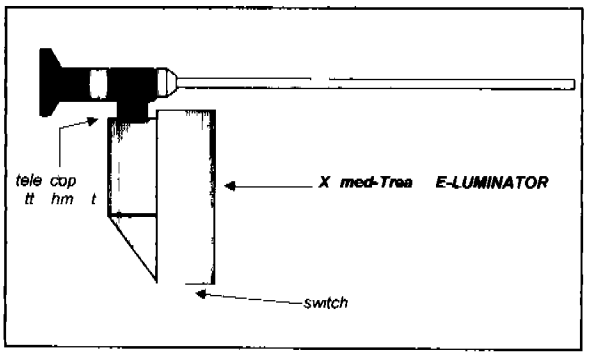

Fig 5 Xomed Treace E LUMINATOR II

Table 1 Comparison of light intensities of different assemblies with SPIDLite (in scales)

Instrument Measured	1 cm	2 cm	3 cm
Otoscope illuminator alone	20 scale	19 scale	18 5 scale
Otoscope illuminator with otoscope head	18 scale	17 5 scale	17 scale
Otoscope illuminator with SPIDLite without telescope	19 scale	18 5 scale	18 scale
Complete setup Otoscope illuminator with SPIDLite & telescope	17 scale	15 scale	14 scale
Xomed Treace without telescope	18 25 scale	18 scale	17 5 scale
Xomed Treace with telescope	14 5 scale	13 scale	12 scale

A unit of scale has an equivalent lux (candlelight power) calibration See Appendix

Results

The conventional otoscope illuminator (Welch Allyn model 20000 and model 25257) emitted light with an intensity of 20 lux scale equivalent to 88 000 lux (A lux is equivalent to one candlelight power placed in a dark room) With the otoscope head attached the light intensity was decreased by 2 lux scales to 18 lux scale or 22 000 lux) With SPIDLite attached to the otoscope illumina or the light intensity 19 lux scale or 44 000 lux Thus SPIDLite emitted more light than the assembly of otoscope with head attached

In fact it surpassed and delivered more light than the commercially available Xomed Treace F LUMINATOR II which only yielded 18 25 lux scale (27 500 lux)

The true test of applicability was proven by the attachment of the telescope to both the Xomed-Treace E-LUMINATOR II and its improvised equivalent, the SPIDLite. Whereas the SPIDLite had a 0.75 lux scale (262.5 lux) advantage over the commercially available light source when used without the telescope, it edged the Xomed-Treace E-LUMINATOR II by as much as 2.5 lux scale (10,500 lux) when the telescope was finally attached. As the light meter was placed further away from the light at 2 and 3 cm, the SPIDlite consistently delivered a brighter illumination than the commercially available Xomed-Treace E-LUMINATOR II.

Thus SPIDLite proved to be superior in efficiency of light delivery as compared to the commercially available hand-held light source.

DISCUSSION

The shaft of a HOPKINS rod telescope contains glass rods with air "lenses" (not actual lenses but merely spaces between glass rods for enhanced optics) to transmit and focus the image (Fig. 10). Illumination for endoscopy is provided via integral fiber optic bundles (Fig. 10) connected to a light ource. The light source bulb may be an incandescent type, halogen, metal halide, or xenon.

A surgical telescope alone cost around US$2,500.00, and its allied equipment, the light source, costs an additional US$2,000.00. Available light cords cost at least US$300. Even the less expensive commercially available portable hand-held direct light source system, such as the Xomed-Treace E-LUMINATOR II, is still a financial burden. It costs around US$20 but is disposable, lasting for only a few weeks to two months at most---still a relatively high price to be paid by physicians in a developing country.

There was no monetary expense incurred in the production of the SPIDLite. The otoscope is a basic diagnostic instrument for physician in general, and for the ENT specialist in particular. We merely expanded its use besides its already many and varied applications.

The suction tubing can be a used one, recycled by thorough cleaning. Should a brand new suction tubing be utilized, it would still cost a mere P200.00. This is still a fraction of the imported commercially manufactured instruments. Thus the SPIDLite can potentially save the Filipino otolaryngologist an astounding US$2,300 by replacing the conventional light source and light cord with a standard piece of ENT equipment, i.e., the otoscope. Furthermore, the Xomed-Treace E-LUMINATOR II is not even available in the Philippines market, making the SPIDLite a more viable and realistic option. When evaluated via a questionnaire, the SPIDLite was noted to be comparable in assembly and ease of use with that of the Xomed-Treace E-LUMINATOR II light source.

CONCLUSION

A simple, practical, and expensive alternative to the costly and commercially available imported light sources and light delivery systems was devised. It used recyclable surgical tubing which easily fit a conventional otoscope for bedside endoscopy. This adaptor, called SPIDLite can be attached the conventional otoscope which serves as a light source to the HOPKINS telescope. The SPIDLite proved to be superior to Xomed-Treace E-LUMINATOR II in light delivery.

Interviewed subjects thought that SPIDLite was comparable in ease of assembly and use with the Xomed-Treace E-LUMINATOR II light source.

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